

---

# **Energy, Efficiency, and Economics of LNG & L/CNG**

**Natural Gas Vehicle Technology Forum  
Dallas, TX**

**January 28, 2003**

---

**Dr. Jim Wegrzyn  
Brookhaven National Laboratory**

# The Five E's of NGVs

---

- **Energy Security:** Fuel economy of 48.5 mpg and 10% alternative fuel will eliminate oil imports
- **Education:** Training, outreach, tiger teams, and codes & standards
- **Environment:** Meeting EPA's 2007 emission standards is critical
- **Efficiency:** 80% efficiency (up to the engine) and better than 34% engine efficiency
- **Economics:** Fuel cost (purchased price plus LUG), vehicle conversion cost, station cost

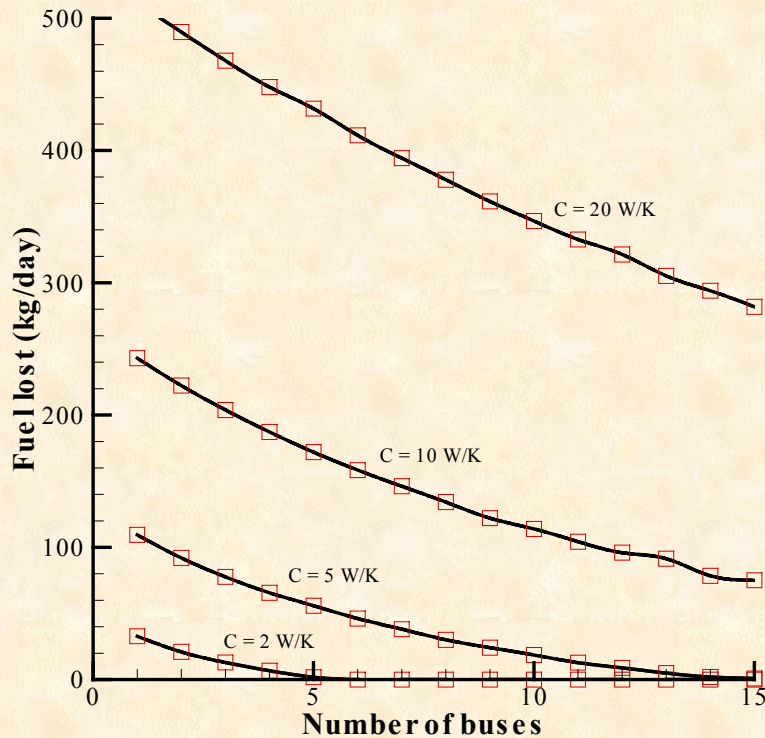
# Features of LNG & L/CNG

---

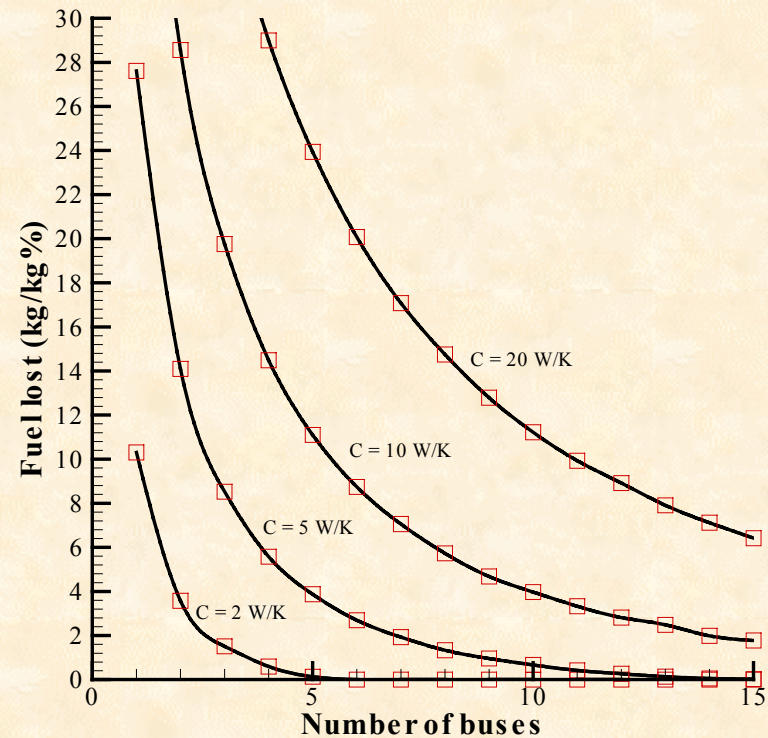
- LNG's main advantage is its 2.5 times increased driving range over CNG
- LNG has the “use it or lose it” problem
- Since there is little risk with CNG, use it if it meets your needs
- L/CNG is not competition to CNG but offers additional refueling sites



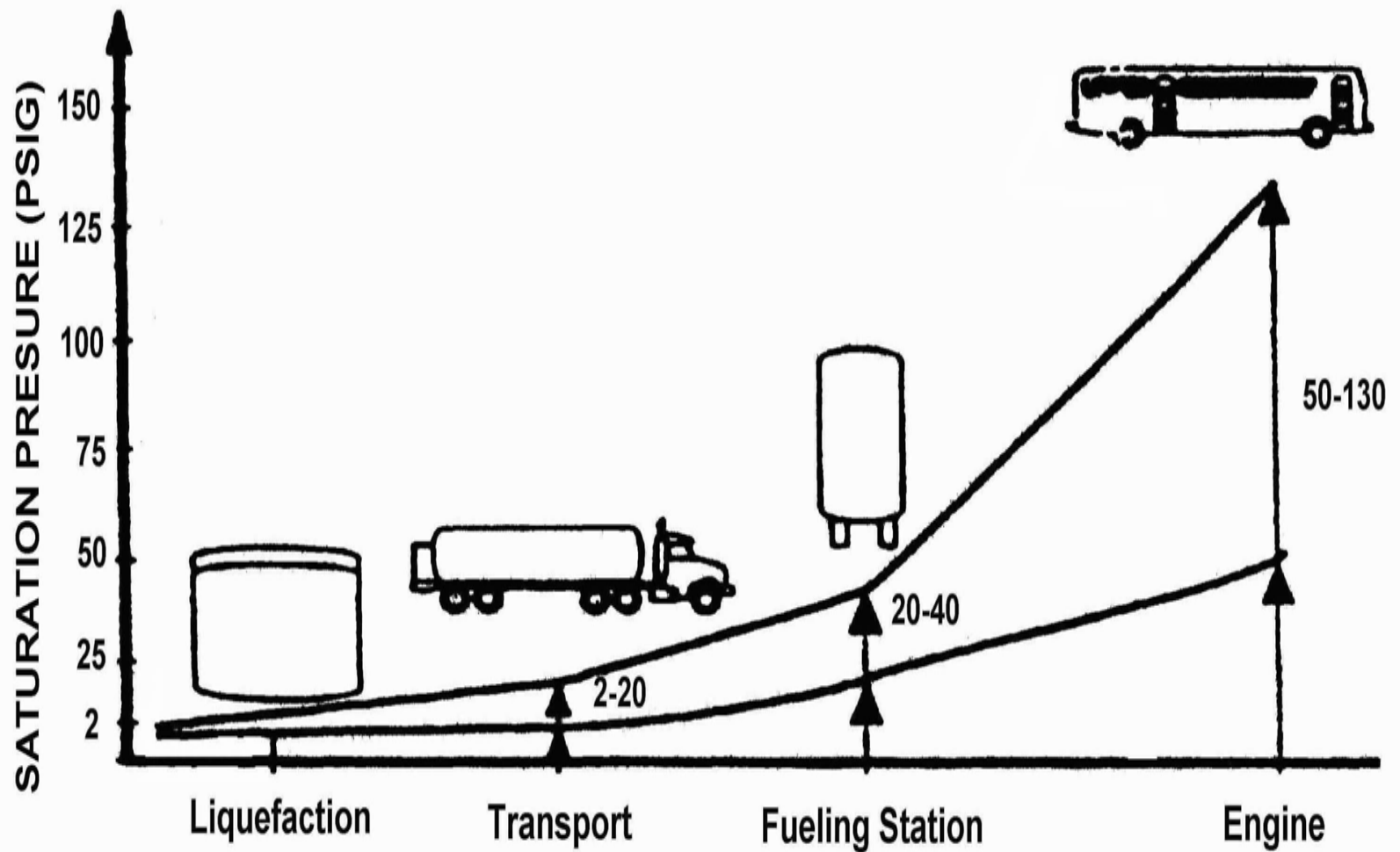
# An Example of “Use it or Lose it”



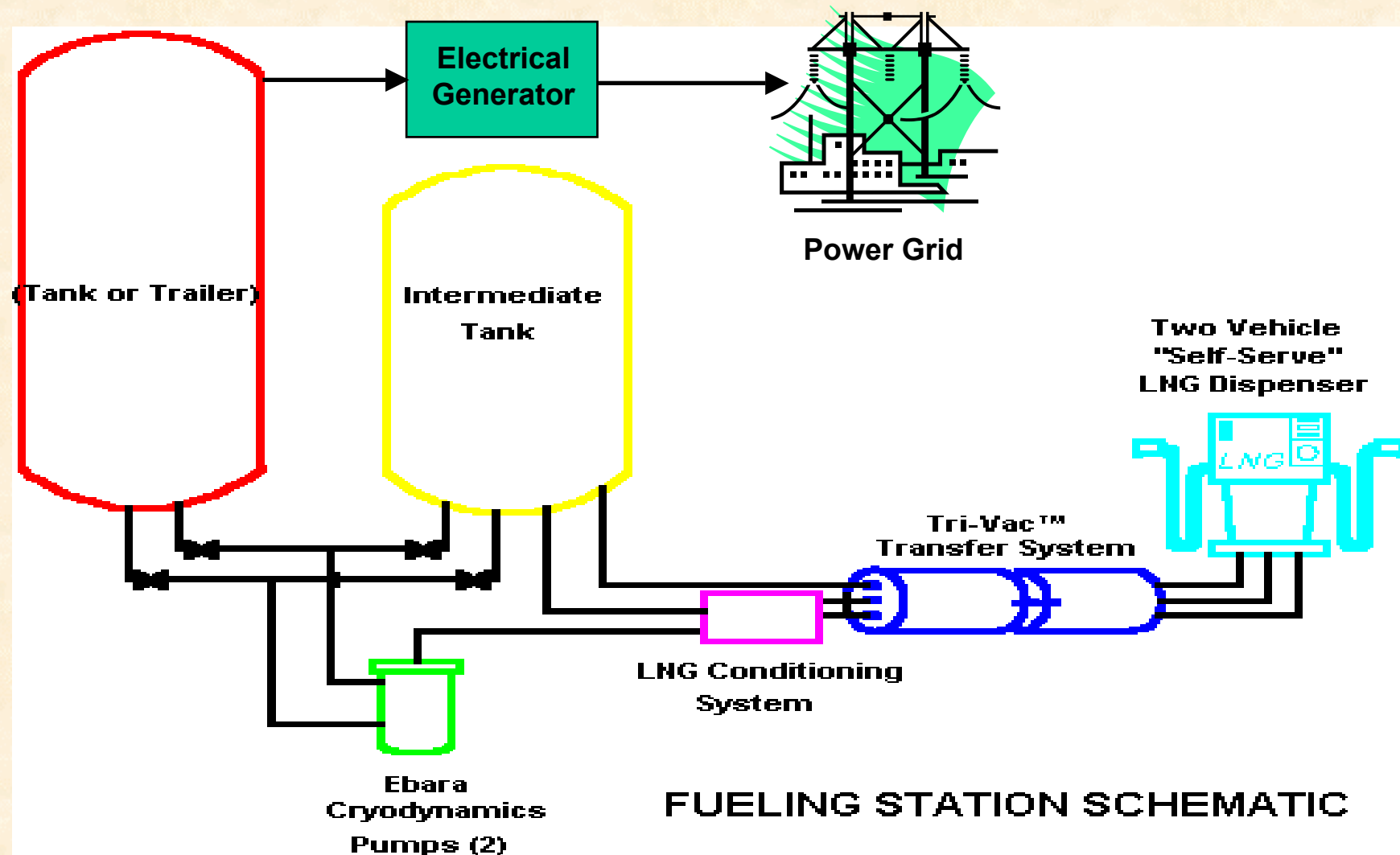
Fuel loss per day



Total fuel loss



# CH-IV Refueling Station



# Economics of LNG

---

- **Capital Cost:** Station and vehicle conversions



- **Operating Costs:** Fuel, maintenance, labor, power, and atmospheric vent (~10% ?)

- **Future Needs:**

Natural gas generator set to eliminate atmospheric vent and for thermal management

- **Conclusion:**

The elimination of atmospheric venting of natural gas from vehicles and stations will improve the economics of LNG much more than a couple of percent improvement in engine efficiency. It is cost per vehicle mile driven that is compared to diesel fuel.